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WHY IS CHILD MALNUTRITION LOWER IN URBAN THAN RURAL AREAS? EVIDENCE FROM 36 DEVELOPING COUNTRIES

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Abstract

While ample evidence documents that urban children generally have better nutritional status than their rural counterparts, recent research suggests that urban malnutrition is on the rise. The environment, choices, and opportunities of urbanites differ greatly from those of rural dwellers—from employment conditions to social and family networks to access to health care and other services. Given these differences, understanding the relative importance of the various determinants of child malnutrition in urban and rural areas—and especially whether they differ—is key to designing context-relevant, effective program and policy responses for stemming malnutrition. This study uses Demographic and Health Survey data from 36 developing countries to address the question of whether the socioeconomic determinants of child nutritional status differ across urban and rural areas. The purpose is to answer the broader question of why child malnutrition rates are lower in urban areas. The socioeconomic determinants examined are women's education, women's status, access to safe water and sanitation, and household economic status. The analysis finds little evidence of differences in the nature of the socioeconomic determinants or in the strength of their associations with child nutritional status across urban and rural areas. As expected, however, it documents marked differences in the levels of these determinants in favor of urban areas. Large gaps in favor of urban areas are also found in the levels of key proximate determinants of child nutritional status, especially maternal prenatal and birthing care, quality of complementary feeding, and immunization of children. The conclusion is that better nutritional status of urban children is probably due to the cumulative effect of a series of more favorable socioeconomic conditions, which, in turn, seems to lead to better caring practices for children and their mothers. Given that the nature of the determinants of child nutritional status is largely the same across urban and rural areas, the same program and policy framework can be used to stem malnutrition in both. Efforts to alleviate the most critical socioeconomic constraints specific to the different environments should continue to be prioritized.

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1. Introduction

Ample evidence shows that urban children generally have a better nutritional status than their rural counterparts (Hussain and Lundven 1987; von Braun et al. 1993; Ruel et al. 1998; Ruel 2001). This is particularly true for linear growth (stunting)[1] and for underweight (low weight-for-age). Using Food and Agricultural Organization of the United Nations (FAO) data for 11 countries, most of which were African, Hussain and Lundven (1987) showed that stunting rates in urban areas were 55–78 percent of those in rural areas. Von Braun et al. (1993) corroborated these findings with United Nations Children's Fund (UNICEF) data sets from 33 countries in Africa, Asia, and the Americas, showing that, on average, stunting was 1.6 times greater in rural than in urban areas. Using Demographic and Health Surveys (DHS) from 28 countries conducted between 1990 and 1998, Ruel (2001) also documented the consistently lower prevalence of stunting in urban areas, with wider urban-rural differences in Latin America than in Africa and Asia.[2] For five of the seven Latin American countries studied, stunting prevalence in urban areas was about half that found in rural areas. Although, typically, wasting is also higher in rural areas, most studies have found very small urban-rural differences. In a few instances, slightly higher wasting in urban areas has been reported (Ruel et al. 1998; Ruel 2001; von Braun et al. 1993; Hussain and Lundven 1987).

In spite of the overall nutritional advantage of children in urban areas, recent evidence suggests that urban poverty and malnutrition have been increasing, both in absolute and in relative terms (Haddad, Ruel, and Garrett 1999). Data from nine of 14 countries studied show that both the number of underweight preschoolers and the share of urban preschoolers in overall numbers of underweight children have been increasing in

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[1] Linear growth refers to growth in height. Stunting is defined as a height-for-age lower than –2 SD from the median of the CDC/WHO reference population (WHO 1979). Underweight is defined as a weight-for-age lower than –2 SD from the median of the reference population; wasting is defined as a weight-for-height lower than –2 SD.

[2] This analysis included 18 countries from Africa, 7 from Latin America, and 3 from South Asia (Bangladesh, Nepal, and Pakistan).

the past 10–15 years.[3] These nine countries constitute a large percentage of the developing world, given that they include China, Nigeria, Egypt, and the Philippines.

Thus, although childhood malnutrition has typically been a less severe problem in urban than in rural areas, the accelerated rates of urbanization currently observed in the developing world raise new concerns regarding increasing rates of urban malnutrition. Understanding the relative importance of the various determinants of childhood malnutrition, and whether they differ between urban and rural areas, thus becomes key to designing effective program and policy responses specifically tailored to the needs of different population groups.

The present study uses DHS data sets for 36 countries from three regions—South Asia, Sub-Saharan Africa, and Latin America and the Caribbean—to address the question of whether the determinants of childhood malnutrition differ between urban and rural areas. The specific objectives of the research are the following:

1. To test whether there are urban-rural differences in the strength of association between key socioeconomic determinants and child nutritional status across and within the three regions. The socioeconomic determinants examined include maternal education, women's status, household water and latrine use, and socioeconomic status.
2. To determine whether the findings differ according to the nutritional status indicator (height-for-age or weight-for-height).
3. To document differences in the levels of the socioeconomic determinants of malnutrition in urban and rural areas.
4. To document differences in the levels of the proximal determinants of malnutrition in urban and rural areas. The proximal determinants examined include maternal nutritional status and maternal and childcare practices, such as

[3] The countries included in this analysis are, in alphabetical order, Bangladesh, Brazil, China, Egypt, Honduras, Madagascar, Malawi, Mauritania, Nigeria, Peru, the Philippines, Tanzania, Uganda, and Zambia (Haddad, Ruel, and Garrett 1999).

prenatal and birthing care, child feeding practices, health-seeking behaviors, and childcare substitute use.

The study follows the approach used by Garret and Ruel (1999) in a single-country analysis (for Mozambique) of the same issue. As in this previous study, the overall hypothesis for this study is that the factors that affect malnutrition in urban and rural areas are different, due primarily to the unique aspects and circumstances that characterize life in urban areas. Among these are the greater dependence on cash income and the lower reliance on agriculture and natural resources; the higher percentage of women-headed households; the greater involvement of women in income-generating activities outside the home; and the smaller family size and weaker social and family networks, and the resulting limited availability of affordable alternative childcare. On the more positive side, urban areas offer more choices: greater availability of food, housing arrangements, health services, and the possibly of employment opportunities. Electricity, water, and sanitation services are also, on average, more widely available than in rural areas. Thus, it is possible that the factors that determine nutritional status differ between urban and rural areas, given these differences in environments and in household and individual opportunities and choices.

Understanding differences in the determinants of childhood malnutrition between urban and rural areas is important to design appropriate, context-relevant program and policy responses. The present research seeks to generate information that will provide guidance to program planners and policymakers on how to design suitable interventions to reverse the trends of increasing urban poverty and malnutrition.

2. Data and Analytical Strategy

Data

This research employs data from 36 of the most recent Demographic and Health Surveys conducted between 1990 and 1998 in South Asia, Sub-Saharan Africa (SSA), and Latin America and the Caribbean (LAC). The countries, years of data collection, and sample sizes are listed in Table 1. Eighty percent of all South Asian countries, 58 percent of SSA countries, and 36 percent of LAC countries are included. The countries were chosen based on the availability of data on child nutritional status. Two regions, East Asia and the Near East and North Africa, were excluded, because not enough data sets were available to give adequate regional representation. The sample analyzed for this paper includes 129,351 children under age 3 and 117,007 women, usually their mothers. Only children under 3 were included because this is the age group common to all data sets.

For background, Table 1 also gives the percentage of sample children living in urban areas in each country and region. The region with the highest percentage of children living in urban areas is LAC, where up to two-thirds (67 percent) live in urban areas. South Asia and SSA have roughly equal percentages (22 and 23 percent). Note that within South Asia, relatively high percentages of children from India and Pakistan live in urban areas, while the percentages are much lower in Bangladesh and Nepal. Among all 36 countries, urbanization is lowest in Rwanda (5 percent) and highest in Brazil (75 percent).

The DHS data sets are from nationally representative surveys of households with at least one woman of reproductive age (usually 15–49 years).[4] The surveys are based on two-stage sample designs. In the first stage, enumeration units or "clusters" are selected from larger regional units within countries. Following, households are randomly selected within clusters. The data are collected by various in-country research and statistical agencies with technical assistance from Macro International, Inc., and major funding from the U.S. Agency for International Development. Due to similar survey instruments and data collection methodologies, the data are largely comparable across countries.

[4] The only exceptions among the countries included in this study are Bangladesh (10–49 years) and India (12–49 years).

Table 1—Study countries, sample sizes, and percentage of children living in urban areas

Region/country	Year of collection	Number of children	Number of women	Percentage children in urban areas
South Asia				
Bangladesh	1997	2,806	2,672	9.3
India	1998	24,677	22,454	23.6
Nepal	1996	3,713	3,370	6.4
Pakistan	1991	2,528	2,231	33.9
All		33,724	30,727	22.7
Sub-Saharan Africa				
Benin	1996	2,284	2,122	31.3
Burkina Faso	1993	2,525	2,406	15.3
Cameroon	1998	1,650	1,495	26.3
Central African Republic	1995	2,253	2,025	41.0
Chad	1996	3,384	3,098	21.2
Comoros	1996	905	784	24.2
Côte d'Ivoire	1994	3,307	3,062	34.1
Ghana	1998	1,634	1,528	25.5
Kenya	1998	2,804	2,523	17.5
Madagascar	1997	2,864	2,596	19.5
Malawi	1992	2,067	1,874	14.0
Mali	1996	4,585	4,200	26.4
Mozambique	1997	2,978	2,809	24.8
Namibia	1992	1,697	1,571	29.6
Niger	1997	3,826	3,502	16.3
Nigeria	1990	3,436	3,100	22.3
Rwanda	1992	2,576	2,367	5.0
Senegal	1992	2,497	2,278	36.6
Tanzania	1996	3,339	3,080	18.0
Togo	1998	3,391	3,173	23.7
Uganda	1995	3,493	3,061	10.9
Zambia	1996	3,576	3,221	38.8
Zimbabwe	1994	2,056	1,911	25.7
All		63,127	57,786	22.1
Latin American and the Caribbean				
Bolivia	1997	3,589	3,152	57.9
Brazil	1996	2,391	2,149	75.4
Colombia	1995	2,730	2,422	63.0
Dominican Republic	1996	2,234	1,928	56.5
Guatemala	1995	5,192	4,401	32.4
Haiti	1995	1,643	1,454	29.3
Nicaragua	1998	3,895	3,449	53.8
Paraguay	1990	2,214	1,812	43.8
Peru	1996	8,612	7,727	59.4
All		32,500	28,494	67.4
All three regions		129,351	117,007	

Notes: County-level percentages of children living in urban areas are calculated using sample weights provided with the DHS data sets. Regional percentages are calculated using a population-weighted average of the country-level percentages.

The DHS data sets were chosen for this analysis because they are one of the best sources of nationally representative data on child nutritional status for a large number of developing countries. When it comes to understanding the determinants of child nutritional status, however, they do have limitations that constrain both the selection of variables and methods used in the analytical strategy. These limitations will be discussed in the following sections.

Measures of Proximal and Socioeconomic Determinants of Child Nutritional Status

The list of determinants of child nutritional status examined in the present research is presented in Table 2. All are closely related to at least one of the three “underlying” determinants of child nutritional status (household food security, care for women and children, and quality of the health environment). These determinants are fundamental to a child’s dietary intakes and health status, which are more immediately related to nutritional status (UNICEF 1998). For the purposes of this study, the underlying determinants are broken into two groups. The first, termed “proximal” determinants, are closely related to biological functions (of both mothers and children) or to specific maternal practices related to food intake, health, and caregiving. They are mother’s nutritional status, prenatal and birthing care for mothers, and caring practices for children. The second group, the “socioeconomic” determinants, represents the resources necessary for achieving adequate food security, childcare, and a healthy environment. They are maternal education, women’s status, access to safe water, access to sanitary toilet facilities, and economic status. Starting with the proximal determinants, the rest of this section gives the rationale for including each variable and a description of how it was measured.

Women’s nutritional status influences children’s nutritional status in a variety of ways, both during pregnancy and early childhood. Women who are malnourished are more likely to deliver smaller babies, who, in turn, are at increased risk of poor growth and development (Gillespie 1997). Additionally, malnourished women may be less successful at breastfeeding their children, have lower energy levels, and have reduced cognitive abilities, all of which hamper their ability to adequately care for their young child (Beard 2001; Engle et al. 1996). In this paper, women’s nutritional status is

Table 2—Measures of determinants of child nutritional status

Variable
Proximal determinants
Mother's nutritional status
Woman's body mass index
Whether woman is underweight
Prenatal and birthing care for mother
Whether woman received any prenatal care
Whether woman with any prenatal care had at least three visits
Number of months before birth at which woman had first prenatal visit (for women with any prenatal care)
Whether woman gave birth in a medical facility
Child feeding practices
Whether breastfeeding was initiated within one day of birth
Whether child 0-4 months is exclusively breastfed
Duration of breastfeeding (months)
Whether child 6-12 months has received complementary foods
Number of times child > 6 months received anything to eat in the last 24 hours
Whether child > 6 months received a high quality food in the last 24 hours
Health seeking behaviors for children
Whether child with diarrhea was treated
Whether child has ever been vaccinated
Whether child received recommended vaccinations for his or her age
Quality of substitute child caretakers
Whether child has adult caretaker while woman works
Socioeconomic determinants
Women's education and status
Whether woman completed primary and secondary school
Woman's relative decisionmaking power within households
Societal gender equality
Household health environment
Whether well and piped water are used (as opposed to surface water)
Whether pit latrines and flush toilets are used (as opposed to neither)
Household economic status
Whether household is destitute, poor, of middle status, or rich

Notes: Data on women's BMI are not available for India, Pakistan, Nigeria, Rwanda, and Paraguay. Data on the diet quality are not available for Bangladesh, India, Pakistan, Burkina Faso, Côte d'Ivoire, Malawi, Namibia, Nigeria, Rwanda, Senegal, Dominican Republic, Haiti, and Paraguay. Data on quality of substitute caretakers for children are not available for Tanzania.

measured using body mass index (BMI), an indicator of energy balance in adults. A BMI less than 18.5 kg/m^2 indicates chronic energy deficiency or undernutrition (WHO 1995).

Two of the most critical caring practices for women that may affect child nutritional status are prenatal and birthing care. Prenatal care provides an opportunity for a number of preventive interventions, including tetanus toxoid immunizations, prevention and treatment of anemia and infections, and detection of high-risk pregnancies needing special delivery care. Delivery in a medical facility is an important element in reducing health risks for mothers and children. Proper medical attention and hygienic conditions during delivery also reduce the risk of infections and facilitate the safe management of obstetric complications (Stewart, Stanton, and Ahmed 1997; Mitra et al. 1997). Medical facilities may also be a source of information for women and an opportunity to disseminate health and nutrition messages. The four variables used in the present analysis to measure care for women focus on whether the care was received and, for prenatal care, the timing and number of visits.

With regard to the care of children, several feeding practices are known to be key to health, nutrition, and development. Initiation of breastfeeding should begin almost immediately after birth, and exclusive breastfeeding should continue for the first six months of life (PAHO/WHO 2003). By six months, high quality complementary foods should be introduced, and breastfeeding should be continued into the second year of a child's life. Since young children have relatively high nutrient requirements but are limited by their small gastric capacity and naive immune system, they need to be fed frequently. Additionally, because of the associated exposure to pathogens and interference with successful breastfeeding, current feeding recommendations strongly discourage use of baby bottles throughout childhood (Brown, Dewey, and Allen 1998; PAHO/WHO 2003). Based on these recommended feeding practices, variables representing timing, duration, frequency, and quality of feeding are used in this paper, as listed in Table 2.

Preventive and curative measures to control infectious diseases in young children are also crucial to their nutritional status. This aspect of care is measured in two ways. The first is whether a child with diarrhea is treated, i.e., taken for treatment to a public or private health facility or practitioner or given home-based treatment, including oral rehydration therapy or increased liquids. The second is receipt of vaccinations. In this study, the measures of child immunization used are whether the child has ever been vaccinated and whether the child has received the recommended vaccinations for his or her age.[5]

Another important determinant of the quality of care received by children is the type of substitute care used by mothers when they are working away from home. Information on this is limited in the DHS surveys, but some data were available on whether the substitute caregiver was a child or an adult. Although older siblings may, in some cases, be skilled and responsive caregivers, it is generally believed that adult caretakers are more suitable substitute caregivers and more likely to provide high-quality childcare (Engle, Menon, and Haddad 1997; Hobcraft 2000).

Turning to the socioeconomic determinants of child nutritional status, numerous studies have consistently concluded that maternal education is a critical resource for child health, nutrition, and survival (Armar-Klemesu et al. 2000; Caldwell 1979; Cebu Team 1991; Cleland and van Ginneken 1988). More educated women are better able to process information, acquire skills, and model positive caring behaviors. They tend to be better able to use health-care facilities, interact effectively with health-care providers, comply with treatment recommendations, and keep their living environment clean. They also are more committed to childcare and tend to stimulate their children more (Engle, Menon, and Haddad 1996). The measure of maternal education used in the paper is constructed as a step dummy variable, with "no education" being the reference category and indicator dummies for both primary and secondary education.[6]

Women's status is defined as "women's power, relative to men, in the households, communities, and nations in which they live" (Smith et al. 2003). Compared to their higher status counterparts, women with low status tend to have weaker control over household resources; tighter constraints on their time; more restricted access to

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[5] This includes one dose of BCG soon after birth to prevent tuberculosis, three doses of polio vaccine to protect against poliomyelitis, three doses of DPT to protect against diphtheria, whooping cough, and tetanus, and a vaccination against measles. The recommendation is that DPT and polio vaccines be given at 6, 10, and 14 weeks of age and that the measles vaccine be given at 9 months (WHO 2002).

[6] The level of education is classified slightly differently across the countries. Additionally, the cutoff for one year (whether fully or partially completed) differs from survey to survey (Gardner 1998).

information and health services; and poorer mental health, self confidence, and self-esteem. All of these factors are closely tied with women's own nutritional status and the quality of care they receive and, in turn, children's birth weights and the quality of care provided to children. In this paper, women's status is measured employing two indexes constructed using factor analysis. The first represents women's decisionmaking power relative to their spouses, i.e., relative power at the *household* level. The indicators on which it is based are whether the woman works for cash, her age at first marriage, percentage difference in age between the woman and her husband, and difference in years of education of the woman and her husband. Although these indicators are calculated at the household level, cluster-level averages of the index are also employed so as not to leave out the large numbers of sample households inhabited by women without husbands.[7] The second index represents gender equality at the *community* level, which may influence child nutritional status in a different manner than the balance of power within households. It is constructed using cluster-level measures of the following indicators: difference in weight-for-age Z-scores of girl and boy children under 5, difference in vaccination attainment of boys and girls,[8] and difference in years of education of adult women and men in the cluster. These indicators represent gender inequality at the societal level (see Smith et al. 2003 for more information).

Lack of access to safe water, and poor environmental sanitation due to unsanitary waste disposal are considered important causes of infectious diseases, especially diarrhea and intestinal parasites (UNICEF 1998). The quality of household health environments is measured in this paper using indicators of type of water and latrine use. For water, the reference category is surface water. Dummy variables for well water and piped water are created and meant to reflect increasingly safe water. For latrine use, the reference

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[7] Previous work using these data was based on a smaller subsample of women with husbands (98.8 percent of sample women in South Asia, 87.9 percent in SSA, and 87.5 percent in LAC), allowing use of the index at the household level (Smith et al. 2003). See footnote 11 for a comparison of the empirical results of this paper, for which the cluster-level average approach is employed, to those when the index is applied directly at the household level.

[8] This indicator is based on the percentage of recommended vaccinations received, given a child's age.

category is no latrine, while dummy variables for pit latrines and flush toilets indicate more sanitary facilities.

Finally, the economic status of a child's household is known to be a strong determinant of nutritional status. Poor households and individuals often have low access to food, a necessary condition for food security. They also may have inadequate resources for childcare, and may not be able to utilize (or contribute to the creation of) resources for health on a sustainable basis. The measure of economic status used in the paper classifies households into four groups: destitute (lowest economic status), poor, middle, and rich. The classification is based on consideration of two factors. The first is the degree to which a household is able to satisfy the basic needs of its members by using its own investments, as opposed to public resources. The variables used to reflect whether basic needs are met are a home with a finished floor, a toilet facility of some kind, and access to water piped into the home. The second factor is ownership of various assets. The assets are broken into two groups, those that are relatively cheap (radio, television, and bicycle) and those that are relatively expensive (refrigerator, motorcycle, and car). The classification is based on *numbers* of basic needs satisfied and cheap or expensive assets owned rather than on any specific type of need or asset in order to maintain cross-country comparability. The four groups and their definitions are as follows:

Destitute: Owns no assets and satisfies either none or only one basic need.

Poor: Owns no assets but satisfies two basic needs, or owns only cheap assets and satisfies either none or only one basic need.

Middle: Owns only cheap assets and satisfies two or three basic needs, or owns at least one expensive asset but satisfies either none or one basic need.

Rich: Owns at least one expensive asset and satisfies two or three basic needs.

Here a "destitute" household owns no luxury items and has an unfinished floor, no toilet facility, and water that is not piped into the home, or has satisfied just one of these needs. By contrast, a "rich" household owns an expensive luxury asset, such as a refrigerator or motorized vehicle, and has satisfied all or almost all basic needs. The poor and middle groups fall in between (see Smith et al. 2003 for additional information).

Analytical Strategy

The central task of this paper is to investigate which determinants of child nutritional status are responsible for children's better nutritional status in urban areas. Both height-for-age Z-score (HAZ), a cumulative indicator of a child's nutritional status, and weight-for-height Z-score (WHZ), which reflects more recent processes often associated with illness leading to weight loss (ACC/SCN 2000), are used as dependent variables. The analysis seeks to establish whether the *levels* of various determinants differ across urban and rural areas and, in addition, whether the strength of association between them and child nutritional status differ. If we found, for example, that education is higher in urban than rural areas, but that it has a very weak association with nutritional status in urban relative to rural areas, then we could not definitively conclude that education is one of the responsible determinants. The first step of the analysis is thus to test for structural differences in the determinants of child nutritional status and their strength of association across urban and rural areas. Note that this analysis focuses on the socioeconomic determinants and does not include the proximal ones. Although it is possible that the strength of association between the proximal determinants and child nutritional status differ across urban and rural areas, formally testing for these differences is beyond the scope of this paper, due to lack of appropriate data.[9] The second step of the analysis is then to compare the levels of both the socioeconomic and proximal determinants across urban and rural areas, taking into account any structural differences found in the socioeconomic determinants.

[9] For example, a proper estimating equation (a "nutrition production function") including both socioeconomic and proximal determinants would necessitate data on children's nutrient intakes, including nutrients derived from breast milk consumption and long-term measures of morbidity, both of which are not available in the DHS data sets. Such an analysis would also need to properly address problems of endogeneity of the proximal determinants, using suitable statistical modeling techniques.

The first step is taken using multivariate regression analysis and Chow F tests for parameter stability (Greene 1997) across urban and rural areas. A country fixed-effects regression model is specified. The explanatory variables include those listed in Table 2 in addition to the child's age (whether in the 1–2 or 2–3 year age group) and sex, the child's mother's age, and household age-sex composition. All explanatory variables are assumed to be contemporaneously exogenous (i.e., the model is a reduced-form model).[10] The country of residence is controlled for using dummy variables for each country. While they are, of course, important determinants of child nutritional status, none of the proximal determinants are included in the regression model. Including them would lead to biased estimation of the regression coefficients of the socioeconomic determinants, because they are themselves pathways through which the socioeconomic determinants influence child nutrition. To illustrate, if we include mother's BMI in the regression equation, the coefficient on women's education would no longer represent the full association between education and child nutrition because of the presence of another independent variable (BMI) that is partially influenced by education.

The dependent variable, child nutritional status (denoted *Y*), is hypothesized to be determined by *K* explanatory variables, denoted *X* and indexed $k = 1\ldots K$. The basic cross-country model takes the form

$$Y_{ic} = \alpha + \sum_{k=1}^{K} \beta_k X_{k,ic} + \mu_c + \upsilon_{ic}, \ \upsilon_{ic} \sim N(0, \sigma^2) \quad i = 1,\ldots,n \quad c = 1,\ldots C,$$

where *i* denotes children and *c* denotes countries. The μc are unobservable country-specific, household-invariant effects, and the νic are stochastic. Unbiased and consistent estimates of βk can be obtained using ordinary least squares (OLS) estimation if the error

[10] Income, wage, and price data are not collected in the DHS data sets. As noted above, instead of these direct measures of households' economic status, a measure based on household assets and amenities is employed. The measure is used to represent households' *real* incomes, taking into account prices. Because of a reliance on assets and amenities, we expect the usual endogeneity problems associated with income (or total expenditures) to be far less serious, and thus assume the economic status variable, along with the others, to be exogeneous to household decisionmaking.

term does not contain components that are correlated with an explanatory variable. The country effects are included to avoid any such bias emanating from country-specific factors that may be correlated with included explanatory variables.

Because of the two-stage sample design of the DHS surveys, more than one household is sampled for each cluster. Thus, the possibility arises that the error term will not be independently and identically distributed. Unobserved cluster-specific attributes will influence the outcome variables similarly for households living in the same cluster, leading to biased estimates of the parameter covariance matrix. Additionally, a Cook-Weisberg test (STATA 2000) indicates strong heteroskedasticity. Thus a robust covariance matrix is used to compute standard errors (and thus t-statistics). Following the previous work in Mozambique (Garrett and Ruel 1999), to examine whether the effects of the socioeconomic determinants differ across urban and rural households, a regression including all of the independent variables and their interactions with an urban dummy variable (0 for rural, 1 for urban) is run. The interaction term for any variable is kept in the equation if it is statistically significant (at least at the 10 percent level), which indicates a significant difference between urban and rural areas. Finally, estimated coefficients of each independent variable are calculated for urban and rural areas. A Chow *F*-test for parameter stability across the three regions reveals strong differences ($F = 48.1$, $p = 0.000$). Thus the urban-rural difference tests are conducted separately for the three regions.

The second step of the empirical analysis, comparing the levels of the proximal and socioeconomic determinants across rural and urban areas, employs tests for significant differences in levels across the areas. If the measure of the determinant is continuous, the test employed is a t-test for differences in means. If the determinant is dichotomous, it is a test for differences in proportions. In the case of the socioeconomic determinants, any differences detected in the strength of impact across rural and urban areas are also taken into account in interpreting the test results.

3. Results

Urban-Rural Differences in Childhood Malnutrition

Child nutritional status is undoubtedly better in urban areas in our sample of countries (Table 3), a finding consistent with previous research. Mean HAZ, in particular, is significantly higher in urban areas, and differences as large or greater than

Table 3—Comparison of child nutritional status across urban and rural areas, by country and region

	Height-for-age		Weight-for-height	
Area	**Rural**	**Urban**	**Rural**	**Urban**
South Asia	-1.94	-1.47***	-0.88	-0.78***
Bangladesh	-1.98	-1.43***	-1.08	-0.80***
India	-1.93	-1.48***	-0.90	-0.82***
Nepal	-1.99	-1.51***	-0.85	-0.56***
Pakistan	-1.95	-1.44***	-0.53	-0.48
Sub-Saharan Africa	-1.47	-1.11***	-0.53	-0.37***
Benin	-1.14	-0.91***	-0.83	-0.72*
Burkina Faso	-1.13	-0.77***	-0.95	-0.69
Cameroon	-1.27	-1.01***	-0.18	-0.04**
Central African Republic	-1.53	-1.18***	-0.46	-0.38
Chad	-1.39	-1.06***	-0.91	-0.88
Comoros	-1.42	-1.38	-0.32	-0.32
Côte d'Ivoire	-1.25	-0.79***	-0.59	-0.47***
Ghana	-1.01	-0.60***	-0.78	-0.60***
Kenya	-1.34	-0.92***	-0.28	0.03***
Madagascar	-1.90	-1.74***	-0.53	-0.39**
Malawi	-1.75	-1.34***	-0.12	-0.03
Mali	-1.32	-0.88***	-1.13	-1.05*
Mozambique	-1.56	-1.20***	-0.34	-0.34
Namibia	-1.41	-0.88***	-0.44	-0.21***
Niger	-1.72	-1.26***	-1.14	-0.84***
Nigeria	-1.53	-1.26***	-0.60	-0.45***
Rwanda	-1.77	-1.16***	-0.23	-0.22
Senegal	-1.16	-0.67***	-0.53	-0.34***
Tanzania	-1.71	-1.29***	-0.44	-0.21***
Togo	-1.10	-0.75***	-0.75	-0.56***
Uganda	-1.56	-1.11***	-0.31	-0.21**
Zambia	-1.76	-1.34***	-0.24	-0.18
Zimbabwe	-1.08	-0.88***	-0.20	0.03***
Latin American and the Caribbean	-1.00	-0.48***	0.09	0.18***
Bolivia	-1.39	-0.82***	0.31	0.39*
Brazil	-0.84	-0.29***	0.12	0.17
Colombia	-0.99	-0.68***	-0.01	0.12***
Dominican Republic	-0.75	-0.32***	0.00	0.23***
Guatemala	-1.98	-1.42***	-0.03	0.01
Haiti	-1.24	-0.93***	-0.47	-0.58*
Nicaragua	-1.26	-0.85***	0.05	0.06
Paraguay	-1.01	-0.55***	0.44	0.41
Peru	-1.48	-0.74***	0.21	0.58***

Notes: Asterisks indicate significant differences across rural and urban areas at the 1 percent (***), 5 percent (**), and 10 percent (*) levels.

0.5 of a Z-score are common, especially in countries of South Asia and LAC. WHZ is also generally higher in urban areas, but the differences are of much smaller magnitude than for HAZ and many are not statistically significant. This common pattern has been previously documented (Ruel et al. 1998).

As can be seen from Figure 1, these differences in mean Z-scores translate into large urban-rural differences in the prevalence of stunting (HAZ < –2 SD below the reference standards, see footnote 1). The difference is greatest for LAC, where the stunting rate in rural areas is more than double that in urban areas. Differences in the prevalence of wasting (WHZ < –2 SD below the reference standards), on the other hand, are much smaller (Figure 2) and practically nonexistent in LAC, where wasting is very uncommon, being at the level expected in a healthy, normally distributed population.

Urban-Rural Differences in the Effects of the Socioeconomic Determinants

Tables 4 and 5 report the results of the tests for structural differences across rural and urban areas in the determinants of HAZ and WHZ, respectively. Coefficients that are

Figure 1—Stunting prevalences across urban and rural areas, by region

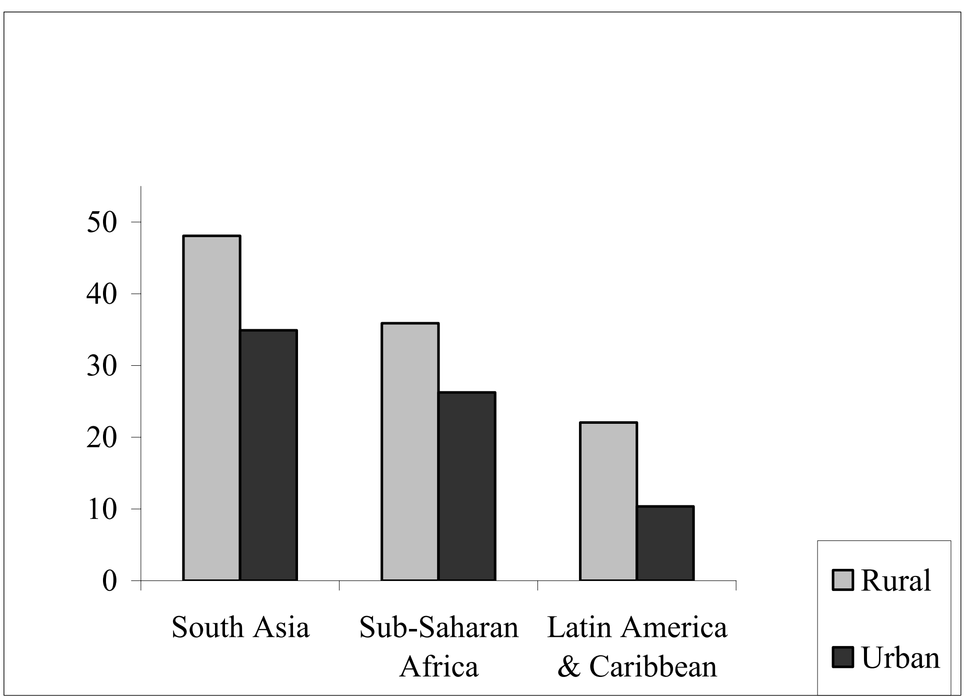
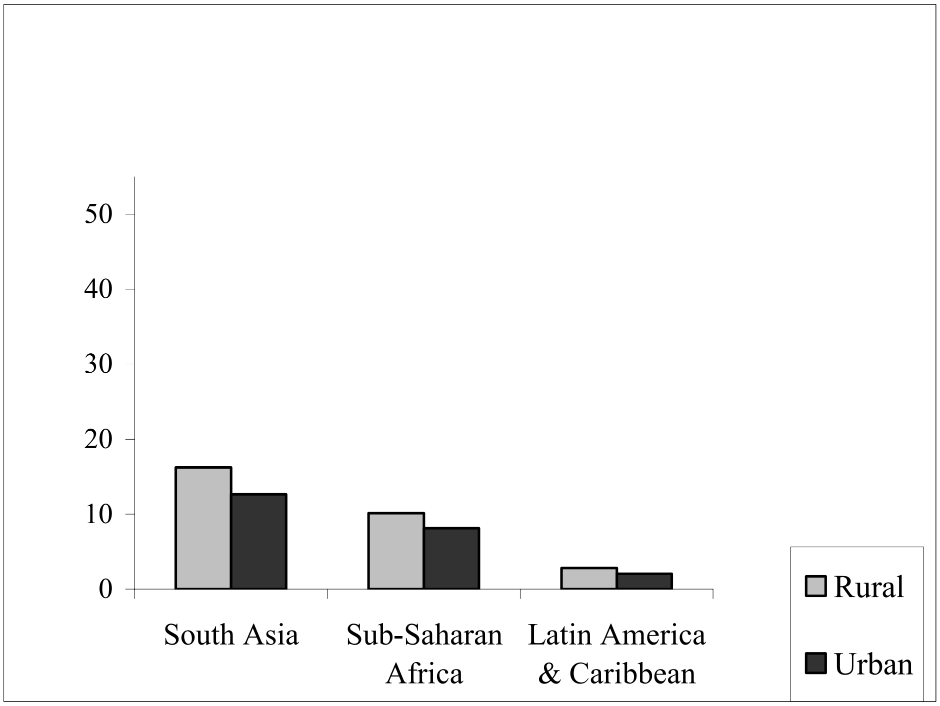


Figure 2—Wasting prevalences across urban and rural areas, by region



significant at least at the 10 percent level are bolded. P-values for the tests of urban-rural differences in the coefficients are only reported where a difference is found to be significant. Note that for variables that have more than one term (i.e., ordered dummy variables, such as that representing women's education), the test statistic represents the *joint* significance of the urban-rural difference.

For both measures of nutritional status, women's education is a significant determinant in all regions. It has a stronger positive association with children's HAZ (Table 4) than WHZ (Table 5). For example, in the SSA region, the HAZ of a child whose mother has a secondary education is 0.31 Z-scores higher than a child whose mother has no education. By contrast, the WHZ increase associated with a woman having a secondary education is only 0.17 Z-scores. This is not entirely surprising—it is likely that maternal education has a cumulative effect on children's nutrition, from as early as during the prenatal period and throughout the first years of a child's life and beyond. Therefore, it is to be expected that HAZ, which reflects cumulative growth, is

Table 4—Determinants of child height-for-age Z-scores: Urban-rural differences

Variable	South Asia Rural	South Asia Urban	South Asia p-value for difference[a] (if significant)	Sub-Saharan Africa Rural	Sub-Saharan Africa Urban	Sub-Saharan Africa p-value for difference[a] (if significant)	Latin America and the Caribbean Rural	Latin America and the Caribbean Urban	Latin America and the Caribbean p-value for difference[a] (if significant)
Woman's education: primary	**0.255**	**0.143**		**0.114**	**0.114**		**0.171**	**0.172**	
Woman's education: secondary	**0.463**	**0.421**	0.065	**0.311**	**0.311**		**0.496**	**0.399**	0.053
Woman's relative decisionmaking power	**0.021**	**0.021**		**0.008**	**0.008**		**-0.009**	**0.005**	0.000
Societal gender equality	**0.002**	0.002		0.001	**-0.003**	0.005	0.001	0.001	
Well water used	0.000	-0.174		0.019	**0.019**		**0.128**	0.167	
Piped water used	0.047	-0.200		0.031	**0.031**		**-0.025**	0.186	0.000
Pit latrine used	**0.107**	**0.107**		0.009	**0.009**		**0.039**	**0.039**	
Flush toilet used	**0.236**	**0.236**		0.196	**0.196**		**0.178**	**0.178**	
Poor	**0.089**	**0.089**		**0.087**	**0.087**		**0.144**	**0.144**	
Middle	**0.226**	**0.226**		**0.233**	**0.233**		**0.309**	**0.309**	
Rich	**0.422**	**0.422**		**0.408**	**0.408**		**0.606**	**0.606**	
Child aged 1-2	**-1.081**	**-0.954**		**-1.176**	**-1.103**		**-1.003**	**-0.697**	
Child aged 2-3	**-1.093**	**-0.863**	0.000	**-1.234**	**-1.095**	0.000	**-0.890**	**-0.433**	0.000
Child's sex (female = 1)	-0.002	-0.002		**0.117**	**0.117**		**0.072**	**0.072**	
Woman's age	0.002	0.002		**0.006**	**0.012**	0.005	**0.009**	**0.009**	
Household size	**-0.008**	**-0.008**		**-0.007**	**-0.007**		**-0.017**	**-0.031**	0.013
Percent females 15-55	**0.006**	**0.006**		0.0001	**0.003**	0.010	**0.008**	**0.008**	
Percent females 55+	**0.003**	**0.003**		0.002	**-0.003**	0.034	0.005	**0.005**	
Percent males 0-15	0.0001	0.0001		-0.0004	-0.0004		**-0.002**	**-0.002**	
Percent males 15-55	**0.002**	0.002		**0.001**	**0.002**	0.021	**0.006**	**0.006**	
Percent males 55+	0.0002	0.0002		-0.001	0.001		**0.004**	**0.004**	
Number of observations	33,724			63,127			32,500		
R-squared	0.170			0.207			0.261		

Notes: All p-values are based on White-corrected standard errors and are robust to intra-cluster correlation. Coefficients of country fixed effects terms not reported. Bolded coefficients signify that the coefficient is statistically significant at the 10 percent or lower level.

[a] For variables constructed using more than one term (ordered dummy variables), the reported statistic is for a test of joint significant difference. Test statistics for urban-rural differences are only reported for variables that have significant coefficients.

Table 5—Determinants of child weight-for-height Z-scores: Urban-rural differences

Variable	South Asia			Sub-Saharan Africa			Latin America and the Caribbean		
	Rural	Urban	p-value for difference[a] (if significant)	Rural	Urban	p-value for difference[a] (if significant)	Rural	Urban	p-value for difference[a] (if significant)
Woman's education: primary	**0.025**	**0.025**		**0.074**	**0.074**		-0.011	**-0.011**	
Woman's education: secondary	**0.099**	**0.099**		**0.168**	**0.168**		0.044	**0.044**	
Woman's relative decisionmaking power	**0.017**	**0.017**		**0.006**	**0.006**		**0.008**	**0.008**	
Societal gender equality	**-0.002**	**-0.002**		-0.001	0.002		**-0.002**	0.002	0.030
Well water used	**-0.081**	-0.081		-0.016	-0.016		-0.028	**0.128**	
Piped water used	**-0.027**	-0.027		0.013	0.013		0.001	**0.269**	0.000
Pit latrine used	**0.208**	**0.195**		**0.064**	0.064		**0.049**	**-0.062**	
Flush toilet used	**0.162**	**-0.001**	0.003	**0.085**	0.085		**0.021**	**-0.010**	0.007
Poor	**0.046**	**0.046**		**0.072**	**0.072**		**0.072**	**0.072**	
Middle	**0.064**	**0.064**		**0.136**	**0.136**		**0.128**	**0.128**	
Rich	**0.242**	**0.242**		**0.222**	**0.222**		**0.200**	**0.200**	
Child aged 1-2	**-0.560**	**-0.341**		**-0.642**	**-0.505**		**-0.663**	**-0.336**	
Child aged 2-3	**-0.379**	**-0.248**	0.000	**-0.315**	**-0.261**	0.000	**-0.543**	**-0.383**	0.000
Child's sex (female = 1)	0.025	0.025		**0.050**	**0.050**		**0.054**	**0.054**	
Woman's age	**-0.004**	-0.004		**-0.005**	-0.002	0.031	-0.0004	**0.003**	0.046
Household size	0.001	0.001		-0.003	**-0.003**		-0.005	**-0.015**	0.044
Percent females 15-55	-0.001	**0.003**	0.013	-0.0004	**0.003**	0.004	0.002	**0.002**	
Percent females 55+	-0.0002	-0.0002		-0.0003	-0.0003		0.002	**0.002**	
Percent males 0-15	0.0003	0.0003		-0.0003	-0.0003		-0.0003	-0.0003	
Percent males 15-55	**0.001**	0.001		0.0005	0.0005		0.000	**0.004**	0.087
Percent males 55+	**0.003**	0.003		0.0002	0.0002		0.001	0.001	
Number of observations	33,724			63,127			32,500		
R-squared	0.065			0.122			0.097		

Notes: All p-values are based on White-corrected standard errors and are robust to intra-cluster correlation. Coefficients of country fixed effects terms not reported. Bolded coefficients signify that the coefficient is statistically significant at the 10 percent or lower level.

[a] For variables constructed using more than one term (ordered dummy variables), the reported statistic is for a test of joint significant difference. Test statistics for urban-rural differences are only reported for variables that have significant coefficients.

more likely to be influenced by the beneficial effects of maternal education over time than the shorter-term WHZ indicator. The tests for parameter stability suggest an urban-rural difference in the strength of association between HAZ and women's education in South Asia and LAC, where education seems to matter more in rural areas. However, the magnitudes of the urban-rural differences are not large.

Turning to women's status, the community average of women's decisionmaking power relative to men's within households is also a significant determinant of child nutritional status for both nutritional status indicators in all three regions. Consistent with previous research (Smith et al. 2003), among the three regions, the association with nutritional status is strongest in South Asia. The parameter stability tests suggest no important structural differences across urban and rural areas in the association between women's relative decisionmaking power and WHZ and, in the cases of South Asia and SSA, for HAZ. However, they do point to a difference in the LAC region: the association between women's relative decisionmaking power and HAZ is positive in urban areas but *negative* in rural areas. This negative association may be related to a negative association between women's decisionmaking power and breastfeeding duration in the region found by Smith et al. (2003). Societal gender equality is found to have quite weak associations with child nutritional status in all three regions.

With respect to the quality of the health environment, the use of well water and piped water appear to have a weak association with children's nutritional status. A disturbing finding is that the use of well water has a *negative* (although small) association with children's WHZ in rural South Asia. This brings into doubt the cleanliness of well water, perhaps due to inadequate protection from human and animal waste or, as appears to be the case in Bangladesh, from groundwater toxins such as arsenic. In terms of structural differences, well water use has a positive association with HAZ in rural areas of LAC but none in urban areas; however, the difference is again not very large. In contrast, quite a substantial urban-rural difference is found in the association between well and piped water use and WHZ in LAC. Here the association appears to be fairly strongly positive in urban areas but not significant in rural areas. It is likely that households that do not have access to well or piped water in urban areas have very few alternatives and probably purchase water at very high cost. This, in turn, is likely to limit use of water and result in poor sanitation and possibly high rates of infections in young children, thus explaining, at least in part, the children's poorer nutritional status (WHZ).

Pit latrine and flush toilet use have moderately strong, positive associations with both HAZ and WHZ in all areas except urban areas of LAC. In LAC, a weak urban-rural difference is found. The pit latrine coefficient on WHZ, for instance, is only 0.11 of a Z-score lower in urban areas than rural areas; the flush toilet coefficient is 0.03 of a Z-score lower. A significant but small urban-rural difference can also be detected for South Asia. Here use of a flush toilet has a weaker association with WHZ in urban areas than rural.

As expected, household economic status has a strong and positive association with both indicators of nutritional status, especially HAZ. The link also appears to be strongest in LAC, which may be related to the excessively large disparities in socioeconomic status in this region. No difference in the strength of the association between economic status and either HAZ or WHZ was detected by the parameter stability tests.

A notable finding is a strong urban-rural difference in the magnitude of the sharp drop-off in nutritional status typically found among children as they move from their first year of life and into their second and third. For both HAZ and WHZ in all three regions, this drop-off is more negative in rural than in urban areas. This was expected because overall, rural children are more malnourished, and therefore their growth faltering is more severe and spread out over a longer time period. The drop-off is more pronounced starting at the end of the first year, rather than at birth or during the first months of life. This is likely due to the protective effect that widespread breastfeeding in rural areas offers to young infants (Ruel 2000; Ruel et al. 1998). Poorer complementary feeding practices in rural areas, starting toward the second half of the first year, which includes lack of dietary diversity and insufficient amounts and frequency of feeding, are probably one of the main causes of the more marked deterioration in growth found during the second and third years of life.

To summarize, we find very little difference in the socioeconomic determinants of child nutritional status or the strength of their association with nutritional status between urban and rural areas, and the differences are generally of small magnitude. The only exceptions are in LAC, where women's relative decisionmaking power has a negative association with HAZ in rural areas but a positive association in urban areas, and where well and piped water use have a fairly strong association with WHZ in urban areas but none in rural areas.[11]

Urban-Rural Differences in the Levels of the Socioeconomic Determinants

Table 6 shows strong differences in the levels of the socioeconomic determinants across urban and rural areas. Women in urban areas are far more likely to have formal schooling than women in rural areas. For example, in South Asia, 62 percent of rural women have no education, while only 32 percent of urban women share this trait. Further, those women who are educated are more likely to have achieved higher levels of education if they live in an urban area. Maternal education is known to have profound beneficial effects on a whole array of child feeding, health seeking, and caregiving practices, as well as on the care of women themselves, which is especially important before and during their reproductive years (Engle et al. 1997; Engle, Menon, and Haddad 1996).

Turning to women's status, while urban-rural differences in societal gender equality are small, we find that urban women generally have higher decisionmaking power relative to their spouses than do their rural counterparts. The only countries for which this is not true are Chad, Central African Republic, and Haiti, which exhibit slight differences against the norm. For South Asia and SSA, this urban relative power advantage means that women in urban areas are, by and large, likely to be better cared for

[11] When the analysis is restricted to the smaller sample of children living in households inhabited by women with husbands (N = 33,316 for South Asia, N = 55,502 for SSA, and N = 28,424 for LAC) and the index of women's relative decisionmaking power is applied at the household level, the same basic conclusion is reached. In this case, however, no significant urban-rural difference is found for women's relative decisionmaking power in LAC.

Table 6—Comparison of socioeconomic determinants of child nutritional status across urban and rural areas, by region

	South Asia		Sub-Saharan Africa		Latin American and the Caribbean	
Variable	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Women's education (percent)						
None	61.80	31.60***	51.62	29.65***	17.99	4.66***
Primary	22.39	24.85	37.44	40.30***	71.26	52.43***
Secondary	15.93	43.52***	10.93	30.05***	10.75	42.92***
Women's status[a]						
Women's relative decisionmaking power	33.22	36.80***	34.45	36.56***	40.72	43.56***
Societal gender equality	50.12	51.81***	56.93	55.79***	59.39	58.95***
Safe water use (percent)						
Surface	4.23	0.71***	40.53	7.71***	11.30	0.41***
Well water	75.35	29.79***	46.27	21.84***	56.38	9.02***
Piped water	20.42	69.49***	13.21	70.45***	32.32	90.57***
Latrine use (percent)						
None	77.40	22.03***	40.53	10.70***	47.16	8.79***
Pit latrine	15.04	18.01***	58.47	70.15***	37.19	36.51***
Flush toilet	7.55	59.96***	1.00	19.16***	15.65	54.70***
Economic status (percent)						
Destitute	37.23	11.60***	34.20	10.17***	17.34	2.02***
Poor	47.64	25.19***	42.75	24.21***	36.21	9.80***
Middle	11.50	31.68***	16.47	36.37***	23.00	23.05***
Rich	3.63	31.53***	6.58	29.25***	23.46	65.13***

Notes: Asterisks indicate significant differences across rural and urban areas at the 1 percent (***), 5 percent (**), and 10 percent (*) levels. Country-level means and percents are calculated using sample weights provided with the DHS data sets. Regional means and percents are calculated using a population-weighted average of the country-level numbers.

[a] These variables are measured on a scale from 0 to 100.

and better prepared and more successful at obtaining resources for their children. In LAC, the same conclusion can be drawn, but for a different reason. In the region, women's relative decisionmaking power has no (for HAZ) or a very weak (for WHZ) association with child nutritional status in urban areas and a *negative* association with it in rural areas. This means that, even in the absence of a relative power difference between urban and rural areas, rural children are at a disadvantage due to this factor.

As expected, the use of piped water is higher in urban than rural areas, in all three regions and in individual countries. However, as discussed, use of piped water has a weak association with child nutritional status. The only exception is in urban areas of LAC, where a fairly strong positive association with WHZ is found. In this region, the large majority (91 percent) of urban dwellers use piped water. Thus, households without access to these facilities are probably in more severely deprived areas and experience the worst sanitary conditions. Children living in these environments are clearly more at risk of infectious diseases and low WHZ. Sanitation facilities, which generally appear to matter more for child nutritional status than water source, are far better in urban than rural areas. In South Asia, for example, well over half of urban dwellers have access to a flush toilet, while only 8 percent of rural dwellers do. We thus expect that these more sanitary conditions in urban areas would have a positive impact on prevention of infectious diseases and as a result on children's nutritional status.

Finally, while substantial proportions of urban households are clearly poor, overall, poverty, as defined by our socioeconomic indicator, is more widespread in rural areas. In SSA, for example, 77 percent of all rural households are either destitute or poor, while only 34 percent of urban households are. Greater access to economic resources means that urban households are less likely to be food insecure and possibly more able to secure the complementary resources necessary to provide adequate care for children, including health services and competent substitute caretakers.[12]

Urban-Rural Differences in the Levels of the Proximal Determinants

Table 7 first compares women's nutritional status and care for women across urban and rural areas. The percentage of urban women who are underweight is consistently lower than the percentage of rural women who are underweight in all countries and regions of our sample. The difference is particularly stark for South Asia, where 44 percent of rural women are underweight, compared to 32 percent of urban women (a nonetheless unacceptably high rate).[13] In the case of prenatal and birthing

[12] It is important to note, however, that, as with most indicators of economic status, the indicator used in this study does not take into consideration the fundamental differences that exist between urban and rural areas in the cost of securing all key basic needs and in household livelihood strategies adopted to fulfill these needs.

[13] The South Asia regional average is based only on data from India and Pakistan. BMI data are not available for Bangladesh and Nepal.

care, again we find a strong urban advantage with few exceptions.[14] In South Asia, where prenatal and birthing care are the lowest among the regions, 84 percent of urban women receive prenatal care, while only 57 percent of rural women do. Among those women who do receive prenatal care, urban women seem to receive better care—they tend to have more prenatal visits and receive them earlier in their pregnancies. Up to 61 percent of urban women also give birth in medical facilities, while only 23 percent of

Table 7—Comparison of proximate determinants of child nutritional status across urban and rural areas, by region

	South Asia		Sub-Saharan Africa		Latin American and the Caribbean	
Variable	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Women's nutritional status[a]						
Woman's body mass index	19.1	20.5***	21.4	22.8***	23.6	24.3***
Percent of women underweight	44.3	32.0***	11.6	8.8***	6.2	5.1***
Prenatal and birthing care for mother						
Percent of women receiving any prenatal care	57.3	83.9***	75.4	93.4***	72.8	92.5***
Percent of women with any prenatal care having at least three visits	58.5	80.1***	78.8	87.9***	86.3	94.4***
Mean number of months before birth of first prenatal visit	4.9	5.6***	4.1	4.4***	5.7	6.4***
Percent of women giving birth in a medical facility	22.5	60.9***	32.5	72.0***	66.7	90.6***
Child feeding practices						
Percent of children for whom breastfeeding initiated within one day of birth	39.6	50.6***	68.6	73.3***	69.6	75.1***
Percent of children 0-4 months exclusively breastfed	54.2	38.3***	20.0	17.7***	34.2	35.9***
Mean number of months of breastfeeding	14.8	12.1***	17.7	15.8***	8.6	7.2***
Percent of children 6-12 months having received complementary foods	42.3	54.6***	80.3	84.0***	79.7	84.6***
Mean number of times child > 6 months eats per day	3.1	3.1	2.9	3.2***	4.5	5.0***
Percent children > 6 months receiving a high quality food[b] (Nepal only)	42.3	54.6***	80.3	84.0***	69.5	80.3***
Health-seeking behaviors for children						
Percent of children with diarrhea who are treated	82.7	91.4***	81.2	90.2***	78.8	89.2***
Percent of children receiving any vaccinations	80.0	90.5***	74.2	90.2***	90.2	96.6***
Percent of children receiving recommended vaccinations	38.6	56.7***	41.8	62.7***	53.1	66.9***
Quality of substitute child caretakers						
Percent of children with adult caretaker while woman works[c]	82.8	91.0***	79.2	87.7***	73.8	91.2***

Notes: Asterisks indicate significant differences across rural and urban areas at the 1 percent (***), 5 percent (**), and 10 percent (*) levels. Country-level means and percents are calculated using sample weights provided with the DHS data sets. Regional means and percents are calculated using a population-weighted average of the country-level numbers.

[a] Data not available for Pakistan, Nigeria, Rwanda, and Paraguay.
[b] Data not available for Bangladesh, India, Pakistan, Burkina Faso, Côte d'Ivoire, Malawi, Namibia, Nigeria, Rwanda, Senegal, Dominican Republic, Haiti, and Paraguay.
[c] Data not available for Tanzania.

[14] The number of months before birth of the first prenatal visit is lower in urban areas in Zambia (3.96 versus 3.78) and Zimbabwe (4.31 versus 4.18).

rural women do. These differences are likely to reflect the greater access to health services, higher education, and higher economic status found in urban areas. Women who are malnourished and who are poorly cared for during the vulnerable periods of pregnancy and childbirth are more at risk of delivering a small baby. The rural-urban differences reported here suggest that urban children are likely to have a nutritional advantage, as early as during life intra-utero and at birth, over rural children.

The patterns observed for child feeding practices are similar to those documented previously, which show that while complementary feeding practices are generally better in urban areas, breastfeeding practices are consistently worse (Ruel et al. 1998; Ruel, Haddad, and Garrett 1999; Ruel 2000). The percentage of children for whom breastfeeding is initiated within one day of birth is higher in urban areas in all regions.[15] This is most likely associated with the higher percentage of births taking place in medical facilities, which exposes women to messages encouraging them to initiate breastfeeding while they are still in the facility. However, as the child grows older, breastfeeding practices generally become relatively worse in urban areas. In South Asia, the percentage of children 0–4 months old who are exclusively breastfed is 54 in rural areas but less than 40 in urban areas. Further, the mean duration of breastfeeding is 2.7 months lower in urban areas. With the notable exception of seven countries,[16] we find the same pattern of urban-rural differences in breastfeeding practices in SSA. In LAC, the percentage of women exclusively breastfeeding is actually slightly higher in urban than rural areas, but breastfeeding duration is 1.4 months lower in urban areas. Differences in women's working patterns between urban and rural areas may explain some of the differences in the duration of breastfeeding observed in Latin America. With increased employment outside the home, continued breastfeeding beyond the first 6–12 months of life becomes more difficult for mothers. This is particularly true in large cities of Latin America,

[15] Country exceptions are Malawi (94.6 versus 87.0 percent), Mozambique (97.3 versus 93.1 percent), Namibia (87.2 versus 83.1 percent), and Nigeria (59.2 versus 58.0).

[16] These countries are Benin (10.5 versus19.6), Chad (0.8 versus 7.7), Ghana (30 versus 49), Mali (10.0 versus 17.1), Niger (0.96 versus 4.0), Togo (13.1 versus 25.6), and Zambia (20.5 versus 50.8).

where a high proportion of women work in the industrial sector—sometimes up to 12 hours a day—in environments that do not allow them to take their child along (Ruel et al. 2002).

On the other hand, the disadvantage of urban children with regards to breastfeeding is often balanced by a strong advantage in complementary feeding practices (Ruel 2000). As documented in previous studies, urban children in our sample were more likely to have received complementary foods by 6–12 months of age (6 months being the recommended age [PAHO/WHO 2003]), were generally fed more often than rural children, and had higher dietary quality (Arimond and Ruel 2000; Ruel 2000).[17] For example, in SSA, while only 42 percent of rural children age 6 months or older are likely to have received a high quality food in the previous day, 55 percent are likely to have done so in urban areas. The ability and desire to feed children a high-quality diet likely stems from the higher education and status of women, higher economic status levels (which improve access to food) in urban areas, and greater availability of food.

Preventive and curative health-seeking behaviors for children are also clearly better in urban than rural areas. Children living in urban areas are more likely to receive treatment when they have diarrhea than rural children.[18] They are also more likely to be immunized and have received their immunizations according to schedule.[19] For example, in SSA, 63 percent of urban children had received the recommended vaccinations for their age, while only 42 percent of rural children had. Like dietary quality, the ability and desire to adequately provide preventive and curative health care for children likely stems from the higher education and status of women, higher economic status levels in urban areas, and greater availability of health services.

[17] Dietary quality data are available for only 22 out of the 36 countries in the study sample (see note b/ of Table 7).

[18] The exceptions among the sample countries are Benin (92.2 versus 90.28), Ghana (93.2 versus 88.3), and Togo (99.1 versus 97.8).

[19] An exception among the sample countries is Guatemala, where 41 percent of rural children receive the recommended vaccinations for their age, while only 36.5 percent of urban children do.

In the present study, the variable used as a proxy for the quality of substitute childcare when mothers work outside the home is the alternative caretaker's age (whether a child or an adult). Here again, for all regions, the quality is higher in urban areas. The greatest urban-rural difference is for LAC, where only 9 percent of urban women leave their young child with a child caretaker, while nearly one-quarter of rural women do so.

4. Discussion and Conclusions

Why Is Child Malnutrition Lower in Urban than Rural Areas?

Our analysis of 36 DHS data sets from three regions of the developing world shows little evidence of differences in the socioeconomic determinants of child nutritional status or in the strength of their association between urban and rural areas. This is true across the three regions and for most of the determinants examined. Where urban-rural differences in the strengths of associations are detected, they are usually of small magnitude.[20]

The socioeconomic factors studied are generally associated with HAZ in the expected direction: higher maternal education and decisionmaking power relative to men within households, improved water and sanitation services, and higher household economic status are all positively associated with HAZ. There are minor differences between regions in the strengths of some of these associations, but they are generally of relatively low magnitude.

The same findings apply to WHZ, although associations with the socioeconomic determinants are generally weaker than with HAZ, and the overall predictive power of the models is lower (as seen by lower adjusted R-squares). This is typically found for WHZ, which seems to be more difficult than HAZ to predict accurately with the types of child, maternal, and household socioeconomic characteristics generally used.

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[20] The only exceptions are that in LAC, women's relative decisionmaking power has a negative association with HAZ in rural areas and a positive association in urban areas, and well and piped water use have a positive association with WHZ in urban areas but none in rural areas.

Thus, to a large extent, our overall hypothesis of the existence of fundamental urban-rural differences in the socioeconomic determinants of children's nutritional status was not confirmed by our multicountry analysis. As expected, however, we found marked differences in the levels of the socioeconomic determinants themselves between urban and rural areas. This is generally true for individual countries as well as overall regional averages. Large differences in favor of urban areas are found in women's education, availability of water and sanitary facilities, socioeconomic status, and, to a lesser extent, women's relative decisionmaking power. Across regions, women living in urban areas are three to four times more likely to have secondary schooling than those who live in rural areas. In South Asia, up to 60 percent of rural women have never attended school, compared to approximately one-third of women in urban areas. Similarly, while 10-20 percent of the urban population lacks access to sanitary facilities, more than three-quarters of the rural population in South Asia, and close to half in SSA and LAC, are in this situation.

Large gaps between urban and rural areas are also observed in levels of all the proximal determinants examined, especially maternal prenatal and birthing care, quality of complementary feeding, and immunization levels. The magnitude of the urban-rural gap is particularly large in the LAC region, but urban areas of all three regions show generally more favorable maternal child-feeding, health-seeking, and care practices. The only exception to this is breastfeeding practices, which are consistently worse in urban areas.

So, consistent with the previous research on Mozambique (Garret and Ruel 1999), our findings suggest that the better nutritional status of urban children compared to their rural counterparts is due to the cumulative effect of a series of more favorable conditions, including better socioeconomic conditions and an advantage related to proximal determinants. Overall, compared to rural children, urban preschoolers have better nourished mothers who also are more likely to receive prenatal and birthing care, which, in turn, may reduce the risk of intrauterine growth retardation. Urban infants are therefore more likely to be born of adequate size and be less susceptible to early morbidity and mortality. These favoring conditions, combined with better feeding practices (especially the greater diversity of complementary foods leading to higher energy and micronutrient intakes), greater use of health services for preventive and curative care, and greater use of adult substitute caretakers result in improved growth and probably reduced morbidity. These characteristics, potentiated by higher maternal education, higher incomes, greater decisionmaking power of women relative to men, and wider availability of health, water, and sanitation services, result in lower rates of childhood malnutrition in urban areas. The conclusion drawn from the Mozambique work, that urban-rural differences in malnutrition are primarily due to differences in the levels of critical determinants rather than in the nature of the determinants themselves, is now corroborated by our global analysis of data from 36 countries from three regions of the developing world.

Limitations of the Study

It is important to recognize the limitations of this analysis. The DHS data sets use a standard questionnaire approach with a predetermined set of variables. The focus is primarily on gathering demographic, health, and nutrition information. The surveys also collect basic data on a number of other characteristics, such as maternal employment, use of alternative childcare arrangements, housing quality, and ownership of assets, but information on these constructs is limited in scope. The main advantage of the DHS data is that the standard approach allows comparisons across countries and regions and data are available for a large number of countries. For some countries, data are available for more than one point in time. This makes these data sets particularly suitable for global analyses such as this one. However, because of the limitation of the data available, proxy measures for some key constructs were used, which may limit interpretation. Socioeconomic status, for example, was derived using information on housing quality, availability of basic services, and ownership of household assets. Although this approach is increasingly popular in the absence of detailed information on income or expenditure

(Filmer and Pritchett 1998; Stifel, Sahn, and Younger 1999), the method warrants further validation. The same is true for other proxy measures used in this study, especially women's relative decisionmaking power[21] and quality of childcare.

As noted in the methods section, data limitations also prevented us from using a "nutrition production function" to formally test the importance of socioeconomic and proximal determinants of nutritional status simultaneously. More detailed information on children's nutrient intakes and data to construct instrumental variables would have been required for this type of analysis.

Policy Implications

In spite of these few data limitations, the analysis presented here is powerful because it demonstrates such a high level of consistency in findings across countries and regions with widely different environmental and economic conditions. There is no doubt that when considered as a whole, urban areas offer more favorable living conditions and opportunities and that this is reflected in better health and nutrition outcomes for children. It is important to recognize, however, that urban areas are not uniform and simple urban-rural comparisons are misleading, because they mask the enormous differentials found within urban areas. A previous study using DHS data for 11 countries from three regions has shown that intra-urban differentials in child stunting are much greater than intra-rural differentials (Menon, Ruel, and Morris 2000). Urban children in the lowest socioeconomic quintile in some countries of Latin America had up to 10 times the risk of stunting than did children in the highest quintile. Intra-rural differentials in stunting risk, on the other hand, were less than 3.5, except in Brazil. Moreover, in most countries, the prevalence of stunting in the poorest urban quintile was almost on par with that of poor rural dwellers.

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[21] See Smith et al. (2003) for a validation analysis of the measure of women's relative decisionmaking power based on data from India, Zimbabwe, Nicaragua, and Egypt.

Thus, we have shown in the present study that, *on average*, urban children are less likely to be malnourished than rural children because, *on average*, they enjoy more favorable environmental and socioeconomic conditions and are generally better cared for. Yet, there are distinct groups of urban children who live in conditions that are at least (if not more) as precarious as those of their rural counterparts and who are as vulnerable and at-risk of poor health and nutrition as rural children.

The fact that the determinants of malnutrition do not differ between urban and rural areas implies that the same program and policy frameworks and tools can be used in both areas. Targeting mechanisms, however, will have to be designed differently for urban areas, because the urban poor tend to be geographically scattered (Morris et al. 1999; Morris 2000) and urban livelihoods are largely dependent on employment away from home for both men and women. This greatly limits the ability of the urban poor to participate in programs and interventions targeted to their place of residence (Ruel 2003). Thus, urban program targeting, implementation, and operations will have to be tailored to take into consideration the specific nature of urban livelihoods and to ensure that interventions complement, rather than interfere with, the livelihood strategies of the urban poor.

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